

laría on the marginal row of cells. 1 d. The dorsal surface, showing the marginal rib and the way in which the tubular fibres originate.

Fig. 2. *Smittia reticulata*, J. MacGillivray, var. A zoœcium with the avicularium.

Fig. 3'. *Smittia Landsborovi*, Johnston, var. *personata*, n., with the normal circular avicularium showing within the opening in the peristome. 3. The same, with large spatulate avicularium replacing the usual form.

Fig. 4. *Smittia trispinosa*, Johnston, var. *spathulata*, Smitt.

Fig. 5. *Smittia trispinosa*, var. *munita*, n.

Fig. 6. *Porina magnirostris*, MacGillivray (sp.). A young marginal cell, and a mature cell (in outline) with the avicularium.

Fig. 7. *Cyelicopora proclonga*, n. gen. & sp. 7 a. The oœcium.

Fig. 8. *Schizoporella biturrita*, n. sp. 8 a. The orifice.

BIBLIOGRAPHICAL NOTICES.

Memoirs of the Geological Survey of India. Palæontologia Indica, being Figures and Descriptions of the Organic Remains procured during the progress of the Geological Survey of India. Series x. Indian Tertiary and post-Tertiary Vertebrata. Vol. II. Part 6. Siwalik and Narbada Carnivora. By R. LYDEKKER, B.A., F.G.S., F.Z.S., with 21 plates and 21 woodcuts. Calcutta: Geological Survey Office. London: Trübner & Co. 1884.

THE Carnivora of the Siwalik and Narbada beds form a sumptuous volume of about 180 pages, illustrated with twenty-one plates and the same number of woodcuts. The memoir begins with the Mustelidæ, and gives a statement of the dental characters of the division termed Mustelinæ, comprising the weasels, glutton, badger, and their allies. The group is but poorly represented in a fossil state. In India there are species of the genus *Mellivora*, which has living representatives in India and South Africa, if, indeed, there be any valid distinction between those rats. The *Mellivora sivalensis* was referred to *Ursituurus* by Falconer and Cautley. It is known chiefly from cranial remains from the valley of the Ganges, and is distinct from the living species. *Mellivora punjabiensis* is a new species, founded upon a mandible; it was about the same size as the living and other fossil rats, but had smaller premolar teeth, whereas in *M. sivalensis* the third and fourth premolars are large. Another genus, represented by a single species, is indicated by the *Mellivorodon palvindiensis*. It, too, is described from mandibles. The fragments are very small, but show some interesting characters, differing from *Mellivora* in features which suggest comparison with the glutton; and it has the bluntly trencant talon to the carnassial tooth which is characteristic of gluttons and rats. We then pass on to the otters. The author discusses the generic dental characters of *Lutra*, and enumerates the living species of the Indian region, also the fossil species, which are mostly known from France and Italy. The Indian species are three in number—the *Lutra*

palæindica, a new species (*Lutra bathygnathus*), and the *Lutra sivalensis*, which Falconer and Cautley referred to *Eulhydrion*, but Mr. Lydekker finds that it agrees with the existing otter in the form of the skull, although much larger. The chief distinction is in the form of the fourth premolar and the relatively greater size of the canine and outer incisor. Such variations, however, as the other species exhibit do not give any indication of their descent from other Carnivora.

The bears are a more interesting group of Carnivora, for Professor Gaudry had already indicated the transition between bears and the dogs which are met with in a fossil state. This relationship has been further elaborated by Dr. Filhol; and the author finds an almost complete transition from the true bears through *Hyænarctos*, which is essentially a bear, to *Dinocyon*, and so through *Cephalogale*, which is related to the dogs, to *Canis*. Thus the palæontologist finds it impossible to refer bears and dogs to separate families, and it is this united group which Mr. Lydekker understands by the term Ursidæ. Although the modern bears are plantigrade and pentadactylate, and the modern dogs digitigrade with only four anterior digits, some of the extinct allies of dogs were both plantigrade and pentadactylate.

Though thus united the author describes the groups separately: the Ursinæ comprise the genera *Æluropus*, *Ursus*, *Arctotherium*, *Hyænarctos*, and *Dinocyon*. The last is found in the Middle and Upper Tertiary of North America, and *Arctotherium* in the newest Tertiary of South America. The living bears are found over the greater part of the world, with the exception of Australasia and a large part of Africa. The earliest appearance of *Ursus* in Europe is in the lower part of the Upper Tertiary. In his preliminary analysis the author indicates seventeen species, while six species originally referred to *Ursus* are now grouped in other genera. The bears are divided, according to the relative width of the palatal aspect of the skull as compared with the first molar, into Macrodonts and Microdonts. Among the Siwalik bears are *Ursus Theobaldi*, which somewhat resembles the *Ursus labiatus*, but has a greater vaulting at the back part of the palate; it is regarded as the ancestor of the living species. And as the *Ursus labiatus* feeds upon insects and fruits, the author sees in the absence of hard substances in the food an explanation of the aborted molar dentition of the living Aswail, and the less developed condition of this character in its fossil ally. *Ursus namadicus* is an old species of the typical Macrodont type, which is distinguished by the size and character of the last premolar and first and second molar teeth. It most resembles the small *Ursus malayamus*, but the evidence is not sufficient to prove it to have been the parent of that type. *Hyænarctos*, originally regarded as a bear by Dr. Falconer, is represented by three fossil Indian species, besides the *H. insignis* of Montpellier and a species in the Middle Tertiary of Spain. The *H. sivalensis* is known from the cranium, mandible, and some bones of the extremities; it has been identified by Professor Flower in the Red Crag of England, though Mr. Lydekker regards the identification as doubtful. Another species

is *H. punjabiensis*, and it is considered probable that the second premolar differs from the corresponding tooth of *H. sivalensis* by being inserted by two fangs, a character which differentiates it from bears and approximates it to *Cephalogale* and dogs. A third species, *H. palaindicus* has the first molar approximating to the dog-like genus *Dinocyon*; it also approximates to the true dogs in the comparative slenderness of the mandible and in the suppression of the third molar, a character which is unknown among bears. By the species *H. punjabiensis* *Hyænarctos* approximates towards the genus *Arctotherium*, and by the species *palaindicus* towards the genus *Dinocyon*. There is no further evidence of the descent of *Hyænarctos*, though, as the tuberculate dentition approaches most nearly to that of Bunodont Suina, it is possible that future discoveries may bridge over what is at present a considerable gap.

The Caninæ form a not less important group than the bears. The author attempts to divide the dogs into Microdents and Macro-dents; but the differences in the proportionate width of the teeth are much less marked than among bears. Among living dogs there is a good deal of variation in the character of the premolar teeth and the number of the molars, *Otocyon* having the molars $\frac{3-4}{4}$, *Canis* m. $\frac{2}{3}$, *Cyon* m. $\frac{2}{2}$, and *Icticyon* $\frac{1-2}{2}$. So that *Icticyon* is the most specialized living dog, for with the diminished development of the molars the carnassial character increases. Among the fossil representatives is *Cynodictis* of the Quercy phosphatites, which, with some affinities to the civet tribe, has other characters linking it with the dog-like bears. *Cynodon* is a genus of the Middle Tertiary of Europe, which, in so far as it differs from *Cynodictis*, approaches *Canis*, but has a Viverrine character in the large size of the talon of the first molar of the mandible.

The modification is traced through *Amphicyon*, in which the molars are more trenchant and compressed than in *Cynodictis*, with a stronger inner tubercle to the upper carnassial than in *Cynodon*, and other characters in the fourth premolar of the mandible indicate an approach to *Canis*. *Amphicyon* is remarkable for having a small third molar in the cranium, a character which is seen in the living *Otocyon*; but the limbs and some parts of the skull have decided resemblances to the bears. The transition is gradual from these types to *Cephalogale* and *Dinocyon*. In the former the number of cheek-teeth is the same as in *Canis*, but some characters of the premolars, like the larger inner tubercle of the fourth and the large hind talon of the first mandibular molar, indicate affinity with *Dinocyon*. In the Indian deposits the dogs comprise only two genera. *Amphicyon* is found in the middle of the Lower Tertiary of Europe; it is known from sixteen fossil species, some of which are confined to North America, but the majority are from France and Central Europe. The only fossil Indian species is *Amphicyon palaindicus*. The genus was identified by Dr. Falconer; and Mr. Lydekker distinguishes the species by the greater specialization of the first molar of the mandible. It apparently extends from the Kangra district to

Sind. The nearest European species is from Bohemia and Styria. The genus *Canis* is made to include *Vulpes*, *Lupus*, *Urocyon*, and their allies. The upper part of the Lower Tertiary of Paris has yielded a mandible, referred to *Canis*, and other remains from the phosphatites of Querey have been referred to the same genus, though they differ from its modern representatives—indicating that typical dogs had not, at that time, appeared in Europe. Cope and Marsh have both described many canine animals from the Tertiaries of North America. Three species are found in the Siwalik rocks of India: first *Canis curvipalatus*, which is compared with the Bengal fox and the Californian *Canis littoralis*; but it tends to bridge over the gap between *Canis* and *Otocyon*, the form of the mandible especially agreeing with *Otocyon*, while resemblances are not wanting in the dentition. Another species is *Canis Cautleyi*, which is a large wolf. Mr. Lydekker compares it, as did Mr. Bosc, with the living Indian wolf, *Canis pallipes*, but differences in the angular processes of the mandible and the relations of the carnassial teeth distinguish it. In some respects the Siwalik wolf is more specialized, so that the author doubts its having been the direct ancestor of the living species. A third species is indicated, and compared with the jackal, but not named.

The next family is the Viverridæ, a group which, at the present day, is related by *Genetta* to the Cats, by *Herpestes* with *Proteles* and the Hyæna, while fossil forms show it to have been connected by *Cynodictis* with the Dogs, and to exhibit a much more intimate connexion than is seen at the present day with both Cats and Hyænas. Of the genus *Viverra* the author indicates twelve species, of which four or five are recent. The genus at the present day is exclusively Asiatic, being limited to the Oriental province, with the exception of *V. civetta*, which is found in North and West Africa. The Siwalik fossil species are the *Viverra Bakeri* and a new form which the author names *V. Durandi*. The former is compared with *V. civetta* and *V. zibetha*, and is considered to have been probably the ancestor of the latter species. *Viverra Durandi* is indicated by a much larger skull, and differs from *V. zibetha* in the greater proportionate width of the frontals across the postorbital process. It is the largest known civet.

The Hyæna family comprises *Hyæna* and *Proteles*. Mr. Lydekker believes that the transition is so complete between *Hyæna* and *Hyænicteis* of Gaudry, that the two genera may be united. It may, however, be convenient not to entirely efface the landmarks of evolution, of which Professor Gaudry's name is certainly one. *Hyæna* is an Old-World type. The living species are found in India, Persia, Asia Minor, and North and South Africa. The fossil representatives have been found in Europe, North Africa, India, and China. The described species number eleven, of which three still exist. The Indian fossil species in addition to these are *Hyæna felina*, *H. Colvini*, *H. macrostoma*, *H. sivalensis*, with indications of another. The *Hyæna felina* is most nearly allied to *H. crocuta*, but readily distinguished by the larger size of the fourth premolar of the

mandible and its talons, the form of the occiput, the occasional absence of the first cranial premolar, and approximation of the second premolar to the canine. The author is disposed to believe that the *H. sinensis* of Professor Owen may be referred to this species. *Hyæna Colvini* is also known from good materials, and is characterized by having the skull and mandible more slender than in *H. felina*, by carnassial teeth of a more decided crocutine type, by the upper true molar being tricuspidate, and other characteristics of the dentition. This species makes a marked approximation to the *Hyæna crocuta*. It shows that *Crocota* cannot conveniently be retained as a separate genus; and, as we have already noticed in other groups, the development of the carnassial teeth is attended with the diminished size of the first molar, or suppression of the first premolar of the mandible. *Hyæna macrostoma* is known from both cranium and mandible: the first molar is large, the palate long and narrow, the form of the posterior nares distinctive, the profile of the sagittal crest is more convex than in allied forms. But while the species is placed in the same genus with existing hyænas, it is regarded as forming a link between that type and the allies of the civets and dogs. From its slender and long jaws it is considered likely that in its habits it may have more resembled the wolves than the living hyænas. *Hyæna sivalensis* is not exactly the species indicated by Mr. Bose from which a good many specimens are separated. Its affinities are towards the species allied to *Hyæna striata*. It has the first molar relatively larger than in the *H. macrostoma*, the premolar shorter and wider. From the large number of species present, Mr. Lydekker is inclined to doubt whether the characters which are made use of in defining the species have really the value claimed for them. The author arranges the species according to the specialization of the teeth, *Hyæna crocuta* standing at one end of the series, with the third lobe of the fourth premolar large and the first molar small; and in the mandible the first premolar is absent, the cusp of the first molar absent, the talon small, and the second molar absent. At the other end is *Hyæna cheretis*, in which the cusp is present, and the talon large in the first molar of the mandible. The author shows, first, a gradual increase in the intervening species of the third lobe of the fourth premolar; secondly, a decrease in size of the first molar; thirdly, a disappearance of the second molar of the mandible and the first premolar; fourthly, a decrease in the talon and a decrease and eventual loss of the inner cusp of the first mandibular molar; and, fifthly, an increasing width of the premolar teeth. The carnassials also become larger as the series approaches *Hyæna crocuta*. The author draws attention to the parallelism which exists between these modifications and those seen among the dogs, cats, and, in a minor degree, among the bears.

The relationship between the lower Hyænas and *Ictitherium* is so close that the distinction between the Hyænidæ and Viverridæ seems almost to vanish, while a new genus, which is described as *Lepthyæna*, brings the Hyænidæ closer to the Cats. *Lepthyæna* was originally

referred to *Ictitherium*. The hinder cheek-teeth are the same in number as in the Weasel tribe, Civets, primitive Hyænas, and Cats, but a closer resemblance is found with the Hyænas, while the fossil resembles the primitive Cats in having a talon and inner cusp to the first mandibular molar. But though it is referred to the Hyænidæ, it is not supposed to be an ancestor of *Hyæna*, but to have stronger relations with the ancestral Felidæ.

The Felidæ are defined as having the carnassials well developed, but with not more than one upper true molar or two lower true molars. In this group 13 genera are placed, and in so far as the author departs from the views of Prof. Cope he follows Prof. Mivart. No attempt is made at a linear arrangement, though the genera as arranged exhibit a progressive advance in the structure of the carnassials and a diminished number of premolars and lower molars. Three lines of development of the Felidæ are represented by the Cheetahs, true Cats, and Machærodonts. The Indian types from the Siwalik beds commence with a description of the new genus *Æluropsis*, of which only one species is known, *Æ. amctans*. The number of hinder cheek-teeth is the same as in *Lepthyæna*; the jaw is very deep, and this depth is perhaps its most distinctive character. A descending symphysial expansion of the jaw is a character common to some primitive Cats and *Machærodus*. The second genus, *Ælurogale*, is represented by a species *Æ. sivalensis*; it is distinguished from *Pseudalurus* by the vertical symphysial ridge, from *Proalurus* in wanting the inner cusp to the first mandibular molar. The species is most closely allied to the *Ælurogale intermedia*, and it is intermediate in size between the Thibetan lynx and the leopard. The third genus, *Felis*, is first known in Europe in the Middle Tertiary of Sansan, and other species occur in America in the Middle Tertiary of the Loup Fork group. *Felis cristata* is the first known of the Siwalik Cats; to this species the author refers the *Felis grandicristata* of Bose. In many respects the skull of the lion approaches nearer to the fossil, though it agrees with the tiger in the relative proportions of face and cranium, and the greater gap between the third premolar and the canine; while the skull of the jaguar in the outline of the profile most closely resembles the fossil. The specimen which was named *grandicristata* probably belonged to an old male. A second species is the *Felis brachygnathus*; the canines are too small to permit of the specimens being associated with *Felis cristata*. A third species, unnamed, is allied to the *Felis pardus*, a fourth to the *Felis lynx*, a fifth is the *Felis subhimalayana*, which was about the size of the jungle-cats of India. A sixth species is indicated, but not determined. The last genus of Cats is *Machærodus*, which commenced at the close of the Lower Tertiary and is common in the Middle Tertiary of Europe, America, and Northern India. Nine species have been described, besides several which are more or less doubtful. There are two Siwalik species, *Machærodus sivalensis* and *M. palæindicus*. The former in its cranial characters comes nearest to the American species *M. necator*; the latter also agrees with this and other American species, but in cranial characters approximates to *M.*

neogaeus, a relationship which is attributed to a line of passage for American and Siwalik life through the regions to the westward of China. Several limb-bones of felines are described and figured, but it has not been found possible to refer them with certainty to species, though their general affinities are indicated. Finally *Hyenodon* is placed as the type of a family in this position. This genus with its allies was placed by Gaudry with the marsupials, by Cope in an order Creodonta, by Huxley they are placed between the Carnivora and Insectivora, and this view is provisionally adopted by the author. *Hyenodon* is otherwise only known from Europe and North America, first appearing in the Paris basin. The *Hyenodon indicus* is only known from very imperfect materials; it resembles the *H. horridus* of America in size, and makes a closer approximation to the smaller *H. Heberti* from Quercy. The part concludes with a bibliography of fossil Carnivora. There are also a preface, contents, and introductory observations, some corrections, and an index to the volume. This monograph is an exceedingly able account of the subject with which it deals, is a great contribution to the history of fossil mammals, and honourable in every way to the Indian Survey and to the author. The manner in which the recent and fossil collections in this country have been utilized in elucidating the fossils shows how great were the difficulties of working at such a distance as Calcutta upon such a subject; but there is happily little in which to differ from the author, unless it be a slight over-anxiety on his part to turn knowledge to account in extracting conclusions from materials which are not always the most satisfactory. We would suggest, too, that in the matter of geological nomenclature terms like Miocene and Pliocene, which are often indefinite, should be discarded for the local names of the deposits which are referred to. The plates show a marked improvement on those executed in India, some of them being of the highest merit. We have said nothing of the excellent arrangement of the matter, of the clear description and terse style, and full quotation of scientific materials; but these, too, merit consideration in a work which must be a standard authority in mammalian palaeontology.

Report on the Zoological Collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. 'Alert,' 1881-82. London: Printed by order of the Trustees [of the British Museum], 1884. 8vo, xxv & 684 pp., 54 pls.

WHEN we know that the handsome volume before us was being prepared during the time of heavy work entailed on the Zoological Department of the British Museum by the removal of the collections from Bloomsbury to South Kensington, we are led to reflect not only on the working-capacities of that staff, but on the multifarious duties that fall on those who are entrusted with the care of our National Collections. In addition to the daily labour of receiving and incorporating the new specimens of which the Museum is